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(54) SERVO BOOSTER MOUNTING

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Claim

1. A servo booster for a vehicle braking system comprising a housing having opposed housing walls, a movable wall positioned between the housing walls and dividing the interior of the housing into two chambers, an input member for operating a control valve assembly controlling the pressure differential between the chambers, an output member having an operative connection with the movable wall, at least one stationary tie extending through the housing walls and through the movable wall, the tie having a cranked portion arranged such that the opposite ends of the tie are displaced transversely from each other, and means sealing the movable wall directly or indirectly to the tie.

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Complete Specification for the invention entitled:

"SERVO BOOSTER FOR VEHICLE BRAKING SYSTEMS"

The following statement is a full description of this invention, including the best method of performing it known to me:—

PF/CP1F/2/80

SERVO BOOSTER FOR VEHICLE BRAKING SYSTEMS

This invention relates to servo boosters for vehicle braking systems of the kind comprising a movable wall dividing the interior of the housing into two chambers and adapted to apply a force to an output member when the chambers are subjected to a pressure differential in response to a force applied to an input member.

The current world-wide shortage of fossil fuel reserves coupled with an ever increasing demand highlights the necessity for fuel saving measures. One example of this is the trend towards lighter motor vehicles. Consideration is given to saving every gram of basic vehicle weight in spite of the extra first cost which this often entails. Thus energy is saved by producing lighter parts and even fossil oil by-products are used to achieve weight saving.

In this connection, it has already been demonstrated that vacuum servo housings can be produced from plastics materials. However, with the usual arrangement in which one shell is connected in use to the vehicle bulkhead, and the other shell through which the output member extends is connected to a master cylinder housing, the output force applied to the master cylinder piston by the booster output member is reacted back to the vehicle bulkhead substantially through the shells of the servo housing.

The quantity of plastics material that has therefore been required to afford the requisite stiffness and fatigue strength of the housing with such designs has been so great that the objective of saving weight and scarce raw material has not been realised.

In our U.S. Patent Specification No. 4,270,353, published 2nd June, 1981 is described a servo booster provided with straight, stationary tie rods extending right through the booster housing, the tie rods being provided with threaded ends for connection to a master cylinder housing and a vehicle bulkhead. The tie rods convey braking reaction forces and substantially relieve the housing shells of braking reaction forces, thereby enabling the use of lightweight housing shells.

According to the present invention a servo booster for a vehicle braking system comprises a housing having opposed walls, a movable wall positioned between the housing walls and dividing the interior of the housing into two chambers, an input member for operating a control valve assembly controlling the pressure differential between the chambers, an output member having an operative connection with the movable wall, at least one stationary tie extending through the housing walls and through the movable wall, the tie having a cranked portion arranged such that the opposite ends of the tie are displaced transversely from each other, and means sealing the movable wall directly or indirectly to the tie.

The cranked portion may be located internally or externally of the booster housing, or possibly within one of the housing walls.

When the booster is mounted in a vehicle in the usual manner, between a master cylinder and a vehicle bulkhead, the tie means will be arranged to convey braking reaction forces from the master cylinder housing to the vehicle bulkhead.

However, servo boosters in accordance with the invention may be mounted in vehicles in other ways. The booster and the master cylinder housing may, for example, be secured together on opposite sides of the vehicle bulkhead, a pivotal support for a brake pedal then being carried by the end of the tie opposite to that which is secured to the master cylinder.

Since the tie is preferably arranged to transmit in use substantially all of the axial forces to which the booster housing would otherwise be subjected, the strength of most of the housing and hence its weight can be reduced and an overall saving in weight may be achieved.

When the tie projects from both housing walls for direct connection at both ends of the booster to respective external members it may be unnecessary to secure the housing walls to the tie. The housing walls are then simply suspended on the tie.

It is an inevitable consequence of inserting the tie through the movable wall of the booster that the movable wall must be sealed in some way to the tie to prevent fluid communication between the two booster chambers. This seal may be arranged in any convenient manner but it should be understood that it need not be made directly with the tie. The movable wall may, for example, be sealed to the interior surface of one of the housing walls by an annular seal which encircles, but does not engage with, one end of the tie.

The tie or ties may each simply comprise a stud of circular cross-section, but any suitable form of tie may be used. The tie may be hollow.

Each sealing means may comprise a seal carried by the movable wall and slidably engaging with the tie, or it may comprise a rolling diaphragm member secured to both the movable wall and the tie.

Preferably each tie is transversely displaced from that axis which extends normally through the centre of the movable wall.

When there are a plurality of ties they are preferably circumferentially equally spaced from one another about said axis.

Preferably there are only two ties and the ties are diametrically spaced from each other with respect to said axis.

When the booster has only two ties the booster may be mounted in use such that the plane which substantially incorporates the two ties is orientated at any convenient angle from 0° to 90° to the vertical.

Each tie may consist of only one member but, of course, it may comprise a plurality of components connected together.

In one preferred arrangement each tie comprises two studs extending longitudinally of the booster and transversely displaced from each other, and a transversely extending bracket secured to adjacent ends of the studs.

Preferably the movable wall comprises a flexible diaphragm and a diaphragm support plate, and each tie extends through the diaphragm support plate.

The movable wall is preferably sealed to each tie by a respective rolling diaphragm, and when the movable wall comprises a flexible diaphragm each rolling diaphragm is preferably integral with the main diaphragm.

When the force transmitting means comprises a tie at least one of the housing walls may be provided with a sleeve which extends inwardly of the housing from the wall and which encases at least part of the tie within the housing, the sleeve being secured to or integral with said wall.

There are various functions which such a sleeve may perform.

When the seal means between the movable wall and the tie comprises a rolling diaphragm the sleeve is preferably dimensioned to provide a support surface for the rolling diaphragm.

When the seal means between the movable wall and the tie comprises a flexible boot or rolling diaphragm provided with a peripheral bead which seats on the tie, the bead may advantageously be located in position on the tie by the free end of the sleeve.

Preferably both housing walls are provided with sleeves which are directed towards each other, the free ends of the sleeves being spaced apart from each other and adapted to locate the bead.

Since the single bead may be arranged to seal with the ends of both sleeves, and since they may be permanently sealed to the housing walls without the use of resilient seals, no further seals which might require

replacement during servicing need be used for sealing the tie to the booster.

In one preferred construction employing such oppositely directed sleeves, the peripheral bead of each rolling diaphragm is of substantially wedge shape in transverse cross-section, increasing in axial thickness in the radially inward direction relative to the axis of the respective tie, and the arrangement is such that the thinnest part of the bead is located between the free ends of the sleeve but without being substantially compressed axially.

When during operation of the booster under high differential pressures the bead is subjected to a radially outward force by the rolling diaphragm the wedge shape of the bead resists outward movement of the bead, and the bead is thus retained in sealing engagement with the sleeve ends, without being subjected under normal conditions to high clamping forces which might result in its early failure.

Preferably the housing comprises opposed housing shells, and said housing walls are walls of the respective shells.

The radially outer peripheries of the housing shells may be adapted to have a snap engagement with each other on assembly of the shells together by relative axial movement.

Two servo boosters for vehicle braking systems will now be described, by way of example only, with reference to the accompanying drawings in which-:

Figure 1 is a longitudinal cross-sectional partial view of a first booster in accordance with the invention with the movable wall shown in its retracted condition; and

Figure 2 is a corresponding view, but omitting the radially inner and outer parts of the booster, of a second booster in accordance with the invention.

The booster of Figure 1 has a housing, generally designated by the reference numeral 1, which is made up of two lightweight, moulded plastics housing shells 2, 3 which have a snap-engagement 4 with each other around their radially outer peripheries to clamp therebetween a thickened outer peripheral bead portion 5 of an elastic diaphragm 6.

A moulded plastics diaphragm support plate 7 together with the diaphragm 6 constitute a movable wall of the booster which partitions the interior of the housing 1 into front and rear housing chambers 8 and 9 respectively.

The servo valve assembly is indicated schematically at 10, but will not be described in detail since its operation is conventional. As is conventional, the servo valve assembly controls the pressure differential between chambers 8 and 9 in response of movement of a booster input rod, not shown. The diaphragm support plate 7 is operatively connected in conventional manner with a booster output rod 11.

A pair of metal tie rods 12, only one shown, extend in a substantially axial direction through the booster housing and through the diaphragm support plate 7. The tie rods 12 are disposed diametrically opposite to each

other, with respect to the axis of output rod 11, and preferably equidistant from the output rod 11. The diaphragm 6 has a main rolling diaphragm portion 13 and a pair of integral rolling diaphragm portions 14 which seal the diaphragm 6 to the respective tie rods.

Front housing shell 3 is provided with an integral rearwardly extending sleeve 15, and rear housing shell 2 is provided with an integral forwardly extending sleeve 16.

The sleeves 15, 16 are disposed around the tie rods 12, and are of approximately equal lengths.

The rolling diaphragm portions 14 terminate in a respective bead 17 of wedge shape in transverse cross-section, the bead increasing in axial width with reducing diameter, and the bead 17 seats against the tie rod 12. The bead 17 is prevented from being pulled radially out of engagement with the tie rod 12, when the diaphragm 6 is subjected to high pressure differentials, by the free ends of the sleeves 15 and 16 which are spaced axially apart to receive snugly the thinner radially outer portion of bead 17 whilst not exerting excessive clamping force on the bead which might eventually damage the bead. The bead 17 may be provided with an annular recess in the face that engages with the tie rod 12 or, as shown in the drawing, the face may be plain. In order to ensure static sealing of the ends of sleeves 15 and 16 to each other, and at the same time to avoid excessive axial compression of the radially outer portion of the bead 17, which may distort the flexible part of rolling diaphragm 14, it may be necessary to compress bead 17 radially between tie 12 and the sleeves 15 and 16.

It should be noted that in addition to sealing the two chambers 8, 9 of the booster from each other the seal 17 also effects a seal between the tie and both housing shells 2 and 3, so that additional seals at the tie ends are not required.

Tie rod 12 adjacent to its front end is formed with a step 18 which is axially displaced from the front surface 19 of housing shell 3. In use the step 18 forms an abutment for the rear end of the master cylinder housing.

The snap engagement at 4 between the radially outer peripheries of the housing shells 2 and 3 is effected by a radially inwardly directed annular lip 20 which is received with axial clearance within a radially outwardly facing annular recess 21 defined between axially spaced outwardly directed annular projections 22 and 23 on shell 3. The free end 24 of the lip 20 and the projection 22 provide complementary abutments, which limit the axial movement of the peripheries of the shells 2 and 3 towards each other under vacuum forces and thus limit the maximum clamping force applied by the shells to the bead 5.

This arrangement of the shell peripheries enables the bead 5 to be installed in the booster with a very small initial compressive loading. The retaining force on the beads is increased when one or both chambers of the booster is subjected to vacuum, but the maximum load on the bead is limited by the engagement between lip 20 and projection 22.

The one-piece tie rods 12 have threaded front and rear end portions 26, 27 respectively which project from the housing 1 for connection respectively to a master cylinder housing and to a vehicle bulkhead. Each tie rod

12 is cranked at 25 so that the threaded ends 26, 27 of that rod are transversely displaced from each other. This provides a different transverse spacing between the front ends 26 of the ties to that between the rear ends 27 of the ties.

This arrangement of the ties enables the threaded ends 26 that are secured in use to the master cylinder housing to be closer together than the ends 27. This may assist in providing sufficient room for valve body 28 of the booster in some applications.

In the modified construction of Figure 2 parts corresponding to those of the construction of Figure 1 have been given corresponding reference numerals. In the construction of Figure 2, the housing shells 2 and 3 are formed of sheet metal, and each tie comprises a stud 29 provided at its rear end with a threaded end portion 27 projecting through housing shell 2 for connection directly to a vehicle bulkhead, a transversely extending pressed metal bracket 30 rivetted at 31 to the front end of stud 29, and a tie end portion in the form of short stud 32 rivetted to bracket 30 and displaced transversely from stud 29. Stud 32 has a threaded end part 26 which projects forwardly through a hole 33 in front housing shell 3, and the stud 32 is sealed to shell 3 by an annular resilient seal 34 sandwiched between shell 3 and a shoulder 35 produced on stud 32 by the rivetting operation, and the front face 36 of bracket 30. In use an annular resilient seal would be located around stud end portion 27 in face contact with rear housing shell 2 to seal the rear booster chamber 9.

In another modification, not illustrated, the bracket 30 is located externally of the housing shell 3.

Brackets may be provided at both ends of a stud if desired.

With further reference to Figure 2, the movable wall of the booster is sealed to each stud 29 by means of rolling diaphragm 14 having an inner peripheral annular bead 17 sealingly received within an annular groove 37 in stud 29 and by an externally grooved outer peripheral bead 38 sealingly embracing the marginal portions of diaphragm support member 7 surrounding a hole 39.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A servo booster for a vehicle braking system comprising a housing having opposed housing walls, a movable wall positioned between the housing walls and dividing the interior of the housing into two chambers, an input member for operating a control valve assembly controlling the pressure differential between the chambers, an output member having an operative connection with the movable wall, at least one stationary tie extending through the housing walls and through the movable wall, the tie having a cranked portion arranged such that the opposite ends of the tie are displaced transversely from each other, and means sealing the movable wall directly or indirectly to the tie.

2. A servo booster as claimed in claim 1 in which the ends of the tie project from the housing walls and are threaded.

3. A servo booster as claimed in claim 1 or claim 2 in which the cranked portion of the tie is located internally of the booster housing.

4. A servo booster as claimed in any of the preceding claims in which the tie comprises two studs extending longitudinally of the booster and transversely displaced from each other, and a transversely extending bracket secured to adjacent ends of the studs.

5. A servo booster substantially as described with reference to Figure 1 of the accompanying drawings.

6. A servo booster substantially as described with reference to Figure 2 of the accompanying drawings.

DATED this 26th day of September, 1983.

LUCAS INDUSTRIES PUBLIC LIMITED COMPANY
~~GIRLING LIMITED~~
By Its Patent Attorneys

CLEMENT HACK & CO.
Fellows Institute of
Patent Attorneys of Australia.

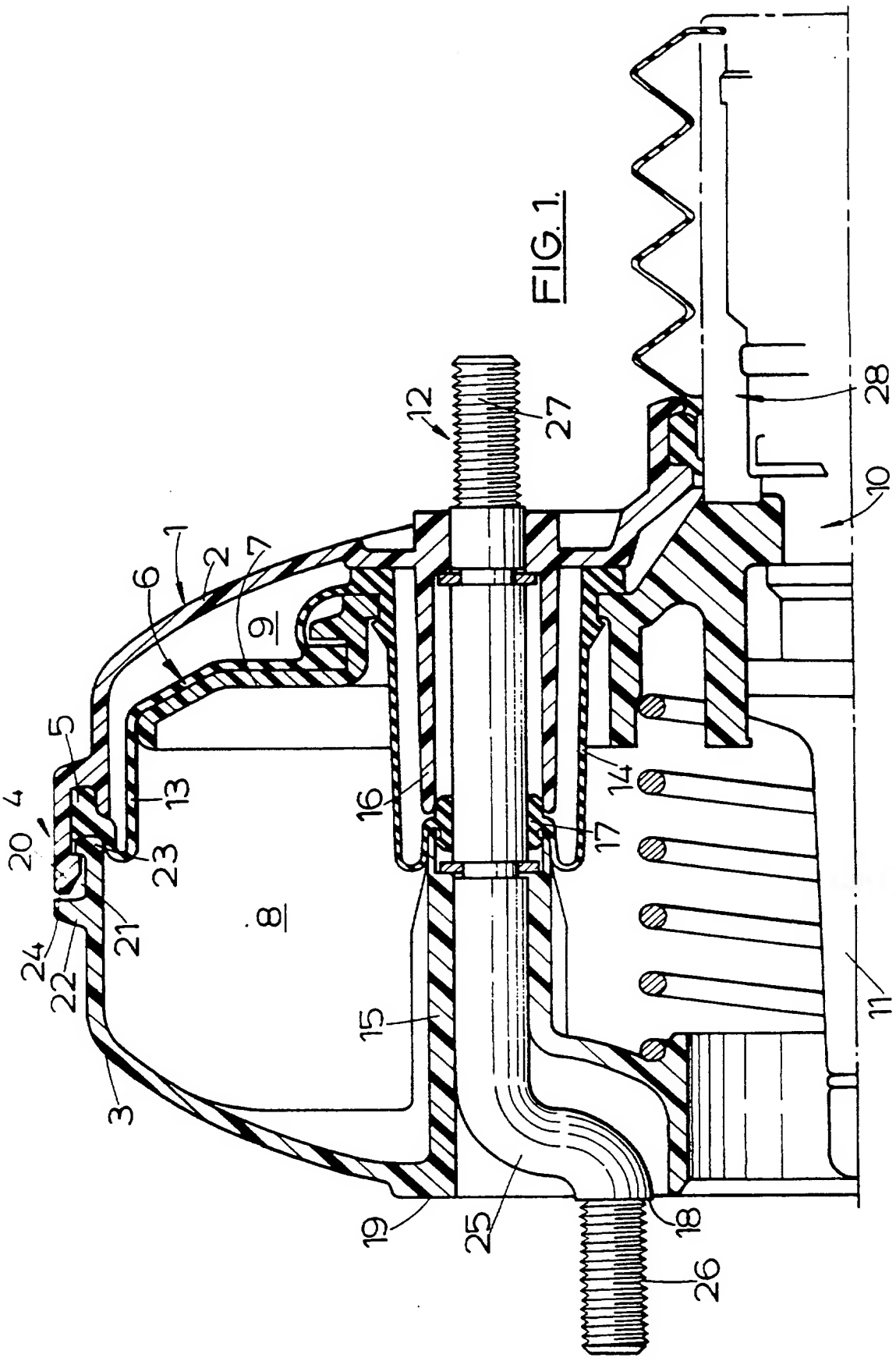

FIG. 1.

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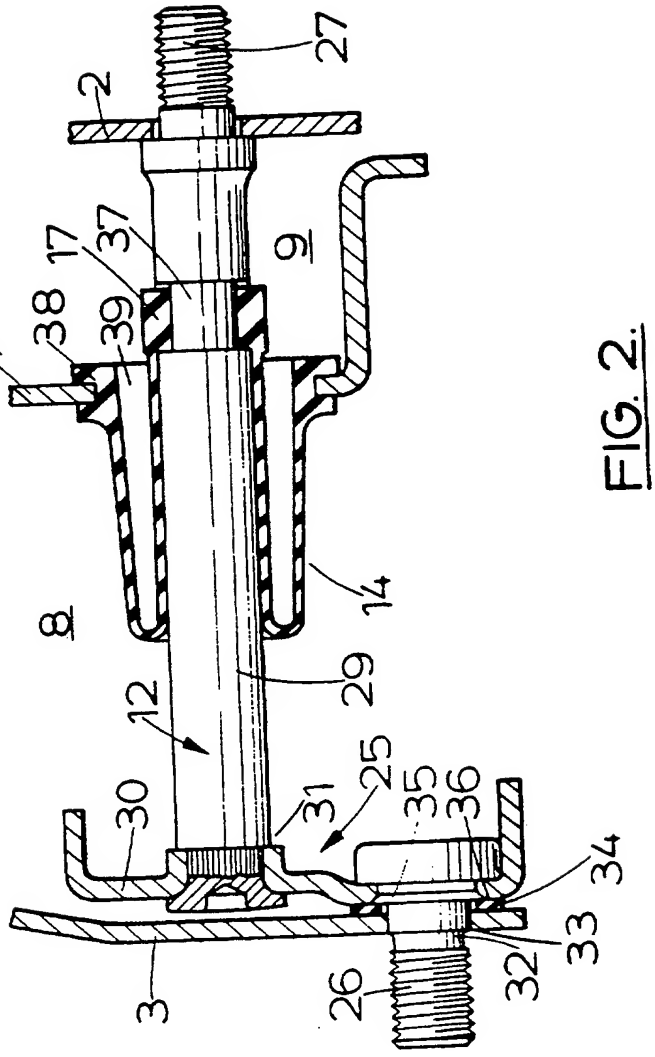

FIG. 2.

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